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1. Your reference — ~~JED1215~~

2. Patent application number *(The Patent Office will fill in this part)* — 0400324.0 — - 8 JAN 2004

3. Full name, address and postcode of the or of each applicant *(underline all surnames)*

Ian Robert THOMSON
41 Marchioness Way
St Neots
PE19 8DL

08JAN04 E863978-1 002806
P01/7700 0.00-0400324.0 ACCOUNT CHA

Patents ADP number *(if you know it)* 83994530001

If the applicant is a corporate body, give the country/state of its incorporation

4. Title of the invention — RAILWAY INSPECTION AND MAINTENANCE SYSTEM

5. Name of your agent *(if you have one)* — Barker Brettell

"Address for service" in the United Kingdom to which all correspondence should be sent *(including the postcode)*

St John's Innovation Centre
Cowley Road
Cambridge
CB4 0WS

Patents ADP number *(if you know it)* 07442494004

~~AS above.~~ ROGER TOLFREE
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A/L 16/1/4 51/77 21/6/04

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Country	Priority application number *(if you know it)*	Date of Filing *(day/month/year)*

7. Divisionals, etc: Complete this section only if this application is a divisional application or resulted from an entitlement dispute (see note f)

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8. Is a Patents Form 7/77 (Statement of inventorship and of right to grant of a patent) required in support of this request? *Answer 'Yes' if:*
a) any applicant named in part 3 is not an inventor, or
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No

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Continuation sheets of this form

Description 6 (x2)

Claim(s)

Abstract

Drawing(s) 3 (x2) only 4

10. If you are also filing any of the following, state how many against each item.

Priority documents

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Statement of inventorship and right to grant of a patent *(Patents Form 7/77)*

Request for preliminary examination *(Patents Form 9/77)*

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Any other documents *(please specify)*

11. I/We request the grant of a patent on the basis of this application.

Signature Barker Brettell Date 08 January 2004

Barker Brettell

12. Name and daytime telephone number of person to contact in the United Kingdom

Toby Gosnall Tel: 0121 456 1364

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Railway Inspection and Maintenance System

Field of the Invention

The invention relates to a system for inspection and maintenance of railway track.

Effective maintenance of railways is becoming increasingly important as the age of the track increases and with new demands imposed by new trains, new schedules and the use of sub-contracted maintenance crews. There have been a number of high profile accidents which have occurred due to poor maintenance of the railways. It is clear that any system would be useful which can help by efficiently checking that maintenance has been carried out correctly and correcting any errors made. Each railway track is fastened to adjacent track by a series of fasteners, primarily fastened into place by rotatable nuts. Incorrect fastening of these nuts can lead to the fastening becoming loose thus jeopardising the connection between those two rails. Keeping each such connection correctly maintained is a challenge given the number of miles of track which need to be checked.

Summary of the Invention

According to the invention there is provided an inspection system for a railway, comprising a plurality of nut alignment indicators, each comprising visual marker means associated with a nut, the position of which varies with the rotational alignment of the nut and a travelling nut alignment checking unit, arranged to travel in the direction of a rail track and comprising at least one alignment sensing unit positioned such that as the checking unit travels along a track, successive nut alignment indicators are visible to the sensing unit, the alignment sensing unit

comparing the position of the visual marker means for each nut with the position indicative of a tightened nut and outputting a signal indicative of whether the nut is tightened sufficiently.

Thus in its simplest form the system may include a series of nut alignment indicators each associated with a nut where a repair has taken place on a railway and a checking unit to be pushed along the track checking one series of nuts and sending out a signal if any such nut has not been tightened a sufficient amount. However, the signal indicating whether the nut has been tightened sufficiently can then be used to operate further maintenance systems.

The nut alignment indicator could be a specially designed nut which as well as being part of the fastening includes at least one registration line which provides the visual marker means which would rotate as the nut rotates. However, preferably the nut alignment indicator is a separate component from the nut which can be subsequently placed over the nut, shaped and sized to provide the visual indication of whether the nut has been tightened to the required degree. Such devices have been developed in the past for visual indication of whether wheel nuts on a car have been tightened sufficiently. The indicators which have been designed for this purpose may have a triangular projection from the perimeter of the nut, the apex of the indicator providing a pointer providing visual indicator means to the naked eye as to whether the wheel nuts on a wheel are tightened to a sufficient degree. Hitherto no automatic checking of such indicator devices has taken place. In an additional, or alternative embodiment, the triangular projection may be replaced with a strip, or the like, extending from the indicator. In one particular embodiment the strip, or the like, has a width of roughly 5mm. Of course, the skilled person will appreciate that other widths are equally suitable and the width

may be roughly any of the following dimensions: 3mm, 4mm, 6mm, 7mm, 8mm, 9mm or 10mm or any other suitable dimension.

In the case where the nut alignment indicators are in the form similar to those used in wheel nut checking with a triangular projection and/or strip or the like with the apex providing a point, preferably the triangular protection also includes a registration line for more easy checking by the sensing unit.

However, the nut alignment indicator may be in the form of a 5mm projecting finger which provides a pointer.

The visual marker means may include a reflective strip, a bar code or an electronic chip which can be sensed by the alignment sensing unit.

The nut alignment indicators may be metal, plastics or other manmade materials.

The moveable checking unit may run next to the track but clearly it is preferable that the checking unit is in the form of a rail vehicle which travels along the rails with the sensing unit mounted to look downwards from the unit onto the track to check the nuts below. The vehicle may be unpowered and may be used coupled to a driven unit or may be a driven unit. Clearly this driven unit could be powered by a form of motor.

Conveniently each such checking unit includes two alignment sensing units, each sensing unit aligned with one rail.

The inspection system may also include sensors which sense the distance between the rails as the checking unit travels along the rails, since variations in the distance between the rails can indicate further

maintenance problems. Preferably the system also includes means to check welds and may include a sensor fitted to the track to check the strain applied to each rail.

The system may also be a maintenance vehicle and include within it means to tighten nuts. Thus when a signal is produced indicative that the nut has not been tightened to a required amount the nut can then be tightened until the visual marker means is in the position indicating tightening to the correct torque.

The vehicle may also include one or more hydraulic arms attached to move debris off the rail, or lift rails from a following carriage or carriages attached to the maintenance vehicles to lay track where required.

The system may also include a video or CCTV unit for checking the environment of the track and preferably includes a lighting system for the system to be used at night.

The system may be arranged to be a remotely controlled unit cutting the man-hours required for checking a railway system.

The system may be used to run down a rail track as part of routine maintenance or may be used to pass over an area where maintenance has taken place to check that the work has been completed correctly and that no nuts have been omitted or incorrectly tightened.

The system may include means to check other maintenance factors such as welds, and may include further maintenance devices to carry out welding when required. The means to check other maintenance factors may include an x-ray source and detector.

Brief Description of the Drawings

An inspection system for a railway will now be described, by way of example only, with reference to the accompanying drawings in which:-

Figure 1 is a plan view of a nut alignment indicator;

Figure 2 is a schematic view of a series of nut alignment indicators in use; and,

Figure 3 is a schematic section of a travelling nut alignment checking unit.

Description of the Preferred Embodiment

An inspection system for a railway comprises a plurality of nut alignment indicators 3 each comprising visual marker means 5 associated with a nut (not shown), the position of which varies with the rotational alignment of the nut and the travelling nut alignment checking unit follows arranged to travel in the direction of a rail track 9 and comprising at least one alignment sensing unit 11 positioned such that as the checking unit 7 travels along a track 9 successive nut alignment indicators 3 are visible to the sensing unit 11. The alignment sensing unit 11 comparing the position of the visual marker means 5 for each nut with the position indicative of a tightened nut and outputting a signal indicative of whether the nut is tightened sufficiently.

In this case the nut alignment indicator 3 comprises a plastics component having a nut engaging portion 13 including a bore 15 of the same section as the nuts to be checked, in this case hexagonal and a projecting finger 5 which forms the visual marker means. To aid the sensing of the visual

marker it includes a reflective upper surface 16 which can be readily seen by the sensing unit 11.

Rails 9 are coupled together using fishplates 17 typically fastened in position by six nuts 19. When the nuts are tightened sufficiently the projecting fingers 5 are aligned with each other and perpendicular to the rails 9. The alignment sensing unit 11 is coupled to a central processor 21 which is coupled to the cab 23 of the unit 7 to provide an indication to the driver of the vehicle that the nuts are or are not tightened effectively. As the skilled addressee of the specification will be aware the issue of a signal that a nut is not aligned properly then prompts action on behalf of the driver as required. The vehicle 7 can be used as a general maintenance vehicle and in this case includes a hoist arm 25 for lifting rails into position for laying track.

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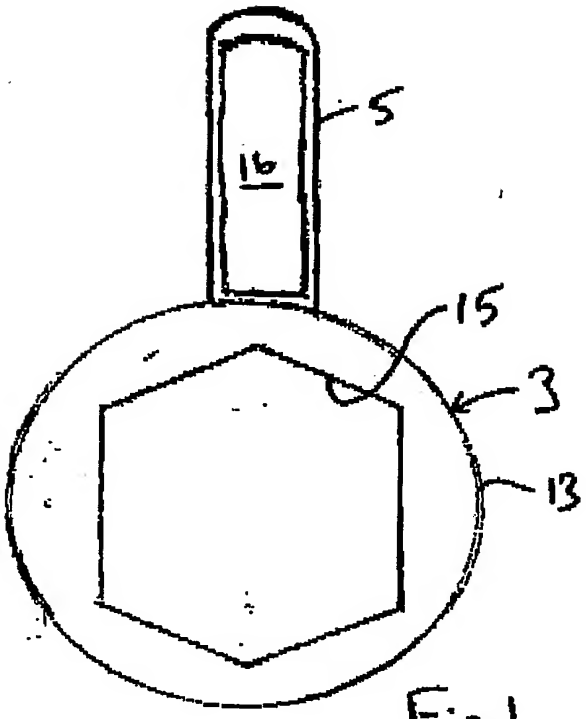

Fig 1

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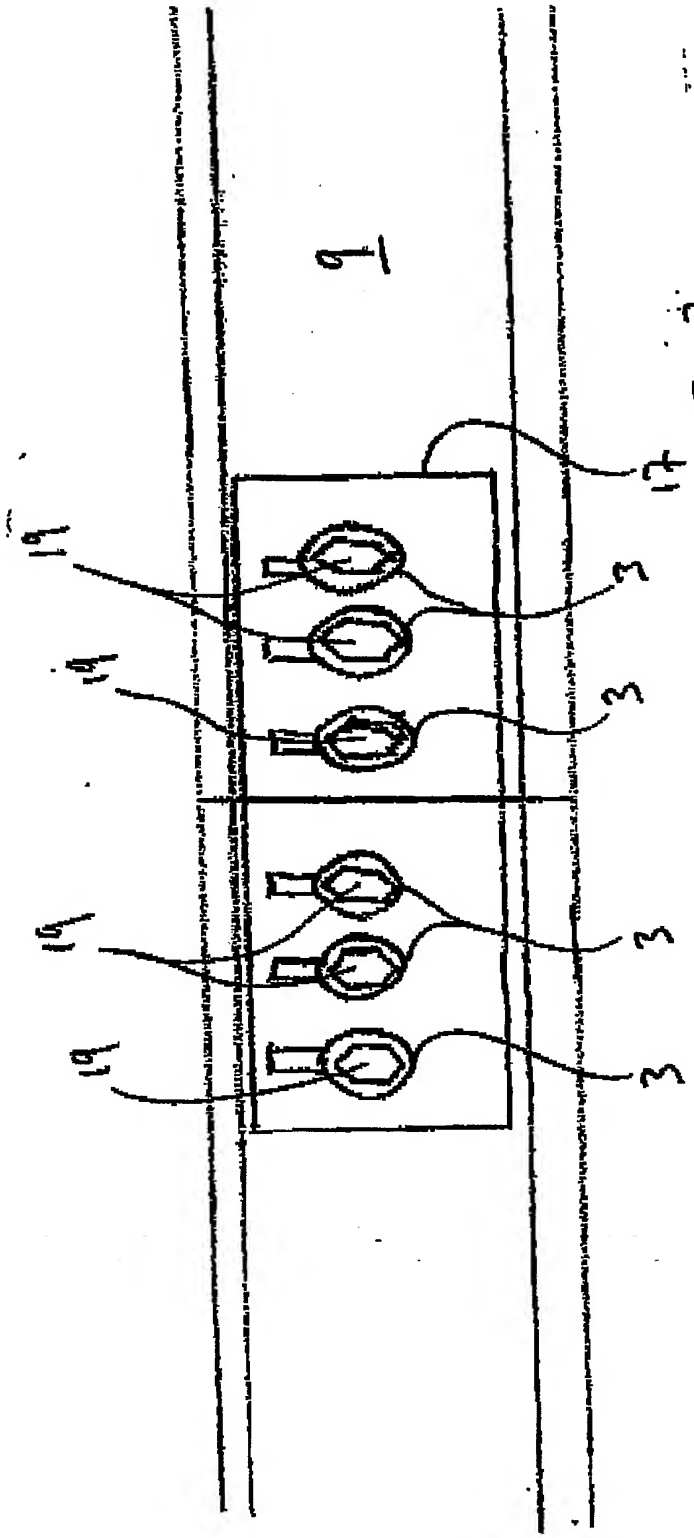

Fig 2

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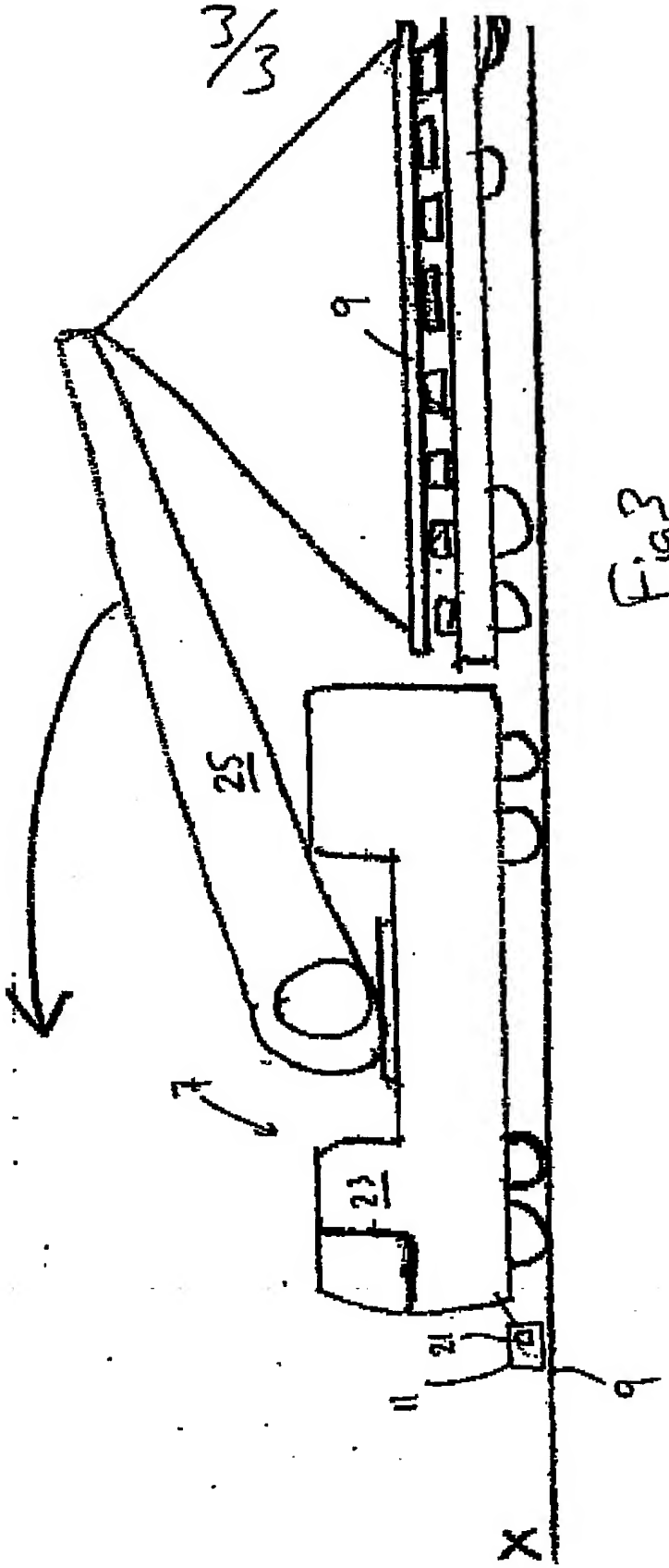

Fig 3